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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1792	

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10/30/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/584,725	KITAOKA ET AL.	
	Examiner	Art Unit	
	MATTHEW J. SONG	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,9 and 12-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,9 and 12-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeong et al (KR 10-2001-0000827), an English Translation (ET) is provided, as applied to claims 1-9 and 15-17 above, and further in view of Yoshida (US 6,534,801).

Jeong et al discloses a method of growing GaN monocrystal by melting where Na is a catalyst and mixing with gallium and a nitrogen gas (ET Claim 1 and Abstract), this reads on growing in a nitrogen containing atmosphere by reacting at least Ga with nitrogen in a melt that includes an alkali metal (Na). Jeong et al also discloses doping with Mg (ET claim 4).

Jeong et al teaches Na and Mg. Jeong et al does not explicitly teach the combination of Na and Mg. The combination of known equivalents for the same purpose is prima facie obvious (MPEP 2144.06). Jeong et al teaches Na and Mg are impurities for doping, which suggests that Na and Mg are equivalents; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jeong et al to use a combination of Na and Mg.

Jeong et al does not teach the claimed amount of Mg.

In a method of making a GaN device, note entire reference, Yoshida teaches a p-type impurity such as Mg is doped during the formation of an undoped GaN layer and setting the dope amount in the range of $2x10^{17}$ to $5x10^{16}$ cm^{-3} produces an electric resistivity of the GaN layer can be made $1x10^{6}$ Ω/cm^2 or more (col 3, ln 35-60). Overlapping ranges are prima facie obvious (MPEP 2144.05). It is also noted that Yoshida teaches different units for resistivity (Ω/cm^2 vs. Ω*cm), however Yoshida teaches resistivity is $1x10^{6}$ Ω/cm^2 or **more** and a similar amount of dopant, as taught by applicant; therefore the resistivity is expected to be within the claimed range because similar materials are expected to have similar properties.

Yoshida teaches a relationship between the amount of dopant and the electrical resistivity of a GaN material, and adding a p-type dopant can compensate for lattice defects. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jeong et al by optimizing the amount of Mg added to obtain the claimed amount by conducting routine experimentation because Mg dopant amount is taught by Yoshida to be a result effective variable, and the concentration of Mg is taught by Yoshida, which overlaps the claimed range is known to produce desirable electrical properties.

Referring to claim 2, Jeong et al discloses doping with Mg.

Referring to claims 3 and 5, Jeong et al discloses doping with Mg, Sr or Ba, which are alkaline-earth metals. (ET claim 4).

Referring to claim 4, Jeong et al discloses nitrogen gas. (ET claim 1 and Abstract)

3. Claims 1-5, 9, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu (US 2004/0003495 A1) in view of Ivantzov et al (US 6,52,124).

Xu teaches a GaN boule grow process comprising adding a metal flux of sodium to a gallium melt, where the presence of the metal flux increases the solubility of nitrogen in the molten gallium to facilitate the fast growth of GaN ([0125]). Xu also teaches an atmosphere of ammonia or nitrogen gas ([0126]). Xu also teaches although sodium is described as an illustrative metal flux species, any other metal flux material may be used in combination, and other flux species include Group I and Group II species ([0128]). Xu teaches a combination of Na and group II metals (mg is a group II metal).

Xu teaches adding a Group II metal, however Xu does not explicitly teach adding Mg.

In a method of making GaN, note entire reference, Ivantzov growing a doped GaN by adding Mg and Zn to a Ga melt to obtain impurity concentrations up to 10^{20} cm^{-2} (col 5, ln 25 to col 6, ln 25).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Xu by adding Mg to dope the GaN, as taught by Ivantoz to obtain a doped crystal with desirable electrical properties.

The combination of Xu and Ivantoz does not teach the proportion of Mg in a sum of Na and Mg is in a range of 0.1-5 mol%.

Xu teaches nitrogen solubility can be increased by optimization of the concentration of the flux metal and the choice of the flux metal, which clearly suggests concentration and flux material are result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Xu and Ivantoz by optimizing the concentration of Na and Mg to obtain the claimed relationship by conducting routine experimentation of a result effective variable. (MPEP 2144.05).

Referring to claims 2 and 3, the combination of Xu and Ivantoz teach doping with Mg and Zn.

Referring to claim 4, the combination of Xu and Ivantoz teach ammonia or nitrogen gas.

Referring to claim 5, this claim limits an alternative of claim 3. The combination of Xu and Ivantoz teach doping with Zn. Claim 5 merely further limits an alternative and is not required because the combination of Xu and Ivantoz teaches the alternative.

Referring to claim 9, the combination of Xu and Ivantoz teaches doping up to a concentration of 10^{20}, overlapping ranges are prima facie obvious. (MPEP 2144.05).

Referring to claims 15-16, the combination of Xu and Ivantoz teaches a GaN substrate with Mg and Zn dopants, which are p-type dopants.

Referring to claim 17, the recitation a field effect transistor has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478,

481 (CCPA 1951). Here, the combination of Xu and Ivantoz teaches the claimed GaN substrate may be used as a substrate for the production of microelectronic and optoelectronic device ('495 [0004]); therefore meets the structure limitations of the claim. A field effect transistor is merely reciting the purpose of the GaN substrate.

Referring to claim 18, the combination of Xu and Ivantoz is silent to the Na has a purity of 99.99%. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Xu and Ivantoz by using Na having at least a purity of 99.99% because impurities are undesirable, and Na having a purity of at least 99.99% is conventionally available in the art.

Referring to claim 19, the combination of Xu and Ivantoz teaches doping with Zn.

4. Claims 12-14, are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu (US 2004/0003495 A1) in view of Ivantzov et al (US 6,52,124), as applied to claims 1-5, 9, and 15-19 above, and further in view of Yoshida (US 6,534,801).

The combination of Xu and Ivantoz teaches all of the limitations of claim 13, except the resistivity is not less than $1x10^3$ ohm-cm.

In a method of making a GaN device, note entire reference, Yoshida teaches a p-type impurity such as Mg is doped during the formation of an undoped GaN layer and setting the dope amount in the range of $2x10^{17}$ to $5x10^{16}$ cm^{-3} produces an electric resistivity of the GaN layer can be made $1x10^6$ Ω/cm^2 or more (col 3, ln 35-60). Overlapping ranges are prima facie obvious (MPEP 2144.05). It is also noted that Yoshida teaches different units for resistivity (Ω/cm^2 vs. Ω*cm), however Yoshida teaches resistivity is $1x10^6$ Ω/cm^2 or more, and a similar

amount of dopant, as taught by applicant; therefore the resistivity is expected to be within the claimed range because similar materials are expected to have similar properties.

Yoshida teaches a relationship between the amount of dopant and the electrical resistivity of a GaN material, and adding a p-type dopant can compensate for lattice defects. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Xu and Ivantoz by optimizing the amount of Mg added to obtain the claimed amount by conducting routine experimentation because Mg dopant amount is taught by Yoshida to be a result effective variable, and the concentration of Mg is taught by Yoshida, which overlaps the claimed range is known to produce desirable electrical properties.

Referring to claim 12, the combination of Xu, Ivantoz and Yoshida does not teach adding oxygen which clearly suggests an oxygen concentration of 0.

Referring to claim 13-14, the combination of Xu, Ivantoz and Yoshida teaches resistivity is $1x10^6$ Ω/cm^2 or **more** and a similar amount of dopant, as taught by applicant; therefore the resistivity is expected to be within the claimed range because similar materials are expected to have similar properties.

Response to Arguments

5. Applicant's arguments with respect to claims 1-5, 9, and 12-19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
October 25, 2008

/Robert M Kunemund/
Primary Examiner, Art Unit 1792